
Pediatric Asthma in Massachusetts 2004 - 2005

Massachusetts Department of Public Health
Center for Environmental Health
250 Washington Street
Boston, MA 02108

March, 2006

Table of Contents

I. Introduction	1
II. Methods	
A. Target Population	3
B. Project Definition of Asthma	3
C. Data Collection	3
D. Data Management	4
E. Data Analysis	4
III. Results	4
A. Participation	4
B. Reported Asthma Prevalence	5
C. Other Variables	5
IV. Discussion	6
V. Future Efforts Aimed at Pediatric Asthma Surveillance	9
VI. References	10
Figures	12
Tables	15
Appendix I. Advisory Committee	20
Appendix II. MDPH Pediatric Asthma Survey, 2004-2005	21
Appendix III. Reported Asthma Prevalence by School	24
Appendix IV. Reported Asthma Prevalence by Community	24

List of Figures and Tables

Figures

Figure 1. Communities Included in the MDPH Pediatric Asthma Survey	13
Figure 2. Distribution of Reported School Asthma Prevalence	14

Tables

Table 1. Variables Collected on the Pediatric Asthma Survey	16
Table 2. Reported Asthma Prevalence by Grade.....	17
Table 3. Answers to Questions Related to School Nurses Records	18
Table 4. Comparison of reported asthma prevalence, 2002 - 2005	19

Acknowledgements

The MDPH would like to thank school nurses in both private and public school systems who contributed to the success of the third year of its pediatric asthma surveillance effort by completing a pediatric asthma surveillance form. We would also like to thank the asthma surveillance advisory committee for its valuable input during both the planning and implementation phases of the project.

Pediatric Asthma In Massachusetts 2004-2005

I. Introduction

Asthma is a common chronic disease among children that appears to have increased in prevalence over the past decades [1]. It affects more than 12% of Americans under the age of 18 [2], and costs \$11.5 billion in direct health care costs annually [3]. The magnitude of prevalence and cost of this disease have made asthma a priority concern among public health organizations across the country.

Historically the information available regarding asthma prevalence in Massachusetts has been limited to prevalence figures for the state as a whole. Statewide prevalence figures have been collected through the Behavioral Risk Factor Surveillance System (BRFSS), a random telephone survey implemented by state health departments in conjunction with the U.S. Centers for Disease Control and Prevention (CDC). Although BRFSS data are useful for estimating asthma prevalence in the state as a whole, they do not provide information regarding asthma at the community level. Before this environmental public health tracking effort, community level data have been available only for a small number of communities in which specialized surveillance programs or research studies have been implemented.

While statewide prevalence figures are a convenient way to summarize the overall health of Commonwealth residents, there remains a need to better quantify the scope of the problem on the state and local level, particularly as it relates to the pediatric population, the population for which the largest increases in asthma prevalence have been detected over time [4]. A standardized pediatric asthma surveillance or “tracking” system that collects asthma prevalence data at the community level allows public health

officials to identify populations with asthma on the local level, evaluate at risk groups, and evaluate the impact of interventions over time more effectively than state-level data.

Given the need for a comprehensive, systematic approach to pediatric asthma tracking in the Commonwealth, the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH), developed a proposal to CDC to track pediatric asthma through school health records. Massachusetts law authorizes the MDPH to access school health records in public health investigations and requires the strict protection of the privacy of the information collected (Massachusetts Student Record Registration Section 23.7 (4) (h) and MGL c111, s 24A). The MDPH also has regulatory authority to access health records for asthma and other selected health outcomes through 105 CMR 300.192; public health regulations for the reporting of communicable and environmentally-related diseases to the MDPH. This authority is consistent with the requirements to protect privacy as provided through the federal Health Insurance Portability and Accountability Act (HIPAA). CEH staff sought assistance from school health nurses in the ascertainment and reporting of children diagnosed with pediatric asthma within each school on an aggregate level. No information that might identify individual students was to be requested. The MDPH received approval for this project as part of a larger effort aimed at tracking several health outcomes thought to be impacted by environmental exposures.

This report describes the methods used to implement the pediatric asthma tracking effort and summarizes the asthma prevalence data collected during year three, which encompassed all public and private schools in the Commonwealth serving grades K through 8. Year one results were released in May 2004, and consisted of data from a smaller number of schools [5]. Year two represented the first time pediatric asthma data were collected statewide. The year two report was released in August 2005 [6].

II. Methods

A. Target Population

During the 2004-2005 school year the MDPH requested all public, private, and charter schools in Massachusetts with any grade Kindergarten through 8 (2,153 schools) to report the number of students with asthma enrolled in the school.

B. Project Definition of Asthma

School nurses provided the number of students with asthma in each school by grade and gender on a standardized report form (Appendix II). Specific sources in the health record for the nurses' knowledge of a child's asthma status included emergency cards, physical exam forms, parent resource centers, parent communications, student communications, health care provider documentation, or direct observation of an asthma attack. The percentage of cases with a documented provider diagnosis or medication orders was requested in the survey.

C. Data Collection

Beginning in March, public school nurses and private school health contacts mailed a one-page reporting form asking for aggregate numbers of children with asthma by grade, gender, and school building (Appendix II). The form also contained questions regarding the source of the data reported. The reporting forms were sent via the U.S. Postal Service. Once the forms were completed, they were faxed or in some cases mailed back to the MDPH. Follow-up telephone calls were placed to nurses who did not respond by May 2005. School enrollment data were collected from the Massachusetts Department of Education (DOE) or from a school's administrative staff. Schools that did not return a complete survey or for which 2004 -2005 enrollment data could not be obtained by September 2005 were considered non-responders.

D. Data Management

MDPH staff reviewed the surveillance forms for completeness and accuracy, and attempted to resolve missing data or inconsistencies. Massachusetts DOE school identifier codes were assigned to each school's surveillance form. In the case of a school that was not listed in the DOE database, or was listed as part of a larger school, the MDPH assigned its own unique identifier code following the DOE code structure. Most surveillance forms were returned by fax and the data electronically entered into a database using a system called Teleform (Cardiff, Vista California). Forms not accepted by Teleform because of electronic reading errors were input manually. Incomplete forms were not input to the project database.

E. Data Analysis

Data analysis was performed with SAS version 9 and Microsoft Access 2000. The percent participation of the target population was calculated, along with the breakdown of submitted surveillance forms by type of school. The prevalence of asthma with 95% confidence intervals was calculated for each participating school, for communities comprised of a single school district (i.e., communities participating in regional school districts were excluded), and for the entire state. Prevalence was estimated for communities that comprised a single school district in order to provide information on prevalence at the community level. However, it was not possible to provide this information for communities that participated in a regional school district because the community of residence of children attending a specific school was not readily available. Additionally, statewide prevalence was calculated by gender and by grade level.

III. Results

A. Participation

MDPH received asthma data from a total of 1,780 public, private, and charter schools; approximately 82.7% of the schools serving any of grades K-8 in the Commonwealth during the school year¹. Of the 1,780 completed report forms, 1,386 were received from public schools (90% participation), 33 from charter schools (72% participation), and 361 from private schools (63% participation). Figures 1a and 1b show the geographic distribution of schools that participated and those that did not participate. Some asthma report forms were incomplete and so could not be included in all prevalence analyses. The number of students with asthma reported from 6 schools could not be used to estimate prevalence by grade and some other schools could not be included in male and female prevalence estimates because of missing or erroneous information.

B. Reported Asthma Prevalence

The reported prevalence of asthma among the 662,994 students enrolled in the 1,780 participating schools was 10.0% (95% CI² 9.9% - 10.1%). Reported prevalence by school ranged from 0 – 48.0%. Prevalence figures for the 1,780 participating schools are listed in Appendix III, and their frequency distribution is presented in Figure 2. Reported asthma prevalence was 9.9 % in charter schools, 10.2% in public schools, and 8.5% in private schools. Reported statewide asthma prevalence for all children by grade ranged from 8.6% (kindergarten) to 10.6 % (7th and 8th grade) (Table 2). Asthma prevalence for males was 11.7% and for females was 8.6% (Table 4).

For the Massachusetts communities comprised of a single school district, prevalence estimates were calculated to represent the prevalence of the city or town. The

¹ Asthma data from 10 schools and enrollment data from 8 schools was incomplete; therefore, these schools were not included in the analyses.

² 95% Confidence Interval (CI) of a the prevalence is a statistical range used to indicate the stability of a prevalence estimate

estimates derived include children with asthma attending private schools located within the city or town. However, some of these students may not be residents of this community. Therefore, the community-specific prevalence figures may be overestimates and should be viewed as approximate indicators of city/town asthma prevalence. The community-specific prevalence estimates are found in Appendix IV. There were 201 communities that were represented by a single school district. The average prevalence for all these communities combined was 9.5 %. This figure is slightly lower than the estimate derived for children attending all schools in the Commonwealth combined. The range of prevalence was 2.6 - 22.1%. This range is smaller than that observed looking at individual schools.

C. Other Variables

Responses to surveillance questions regarding related information in the nurses' health records are summarized in Table 3. The percent of students with an asthma action plan as a component of their school health record ranged from 0 - 98%, and averaged 25.7%. When asked which other components of the health record nurses used to determine asthma status, parent communications and MD diagnosis were reported most frequently (Table 3.)

IV. Discussion

School-Specific Prevalence

While there was notable variation in reported asthma prevalence between schools (range of 0 – 48.0%), caution should be used when comparing school prevalence estimates. It is likely that differences in school health record keeping and reporting account for some of the differences observed between schools. In order to better understand this issue, the MDPH plans to verify school nurse reported asthma data against the reports of other nurses and physician's medical records during year four.

It is also important to note that a higher prevalence of asthma at one school compared with another does not necessarily indicate that environmental problems within that school are the primary factor(s) responsible. Pediatric respiratory symptoms have been associated with a number of factors including exposures in the outdoor environment [7-9], exposures in the home environment [10-12], genetic factors [13, 14], and lifestyle factors [15, 16]. The MDPH pediatric asthma tracking project is a surveillance effort, not a research study. Therefore the data alone cannot be used to draw conclusions regarding the causes of reported asthma prevalence in any school. A MDPH companion effort, however, is tracking indoor environmental data in a number of schools statewide with the ultimate goal of linking the datasets. Similar environmental linkage efforts are underway for each of the health outcome tracking efforts funded under the CDC award.

Community Prevalence

In year two, pediatric asthma surveillance data were reported by individual school only. In year three, however, additional estimates of prevalence for individual cities and towns were made for any community comprised of a single school district. As stated above, these estimates could not be made for communities that participated in regional school districts since the community of residence of a student was unknown. Because a city or town's prevalence figure included students attending public and private schools in that community, the prevalence estimate could include students attending the school but who live in another town or exclude students with asthma who live in a community but attend school in another city or town. As a result, the city/town asthma prevalence estimates may be over- or underestimates of the community's true prevalence of diagnosed asthma. These estimates, nevertheless, give a view of prevalence on the community level that has not previously been available. In future years, Massachusetts will work toward learning the community of residence of all children attending Massachusetts schools with asthma so that more precise prevalence rates can be determined for all Massachusetts cities and towns. The ultimate goal of this asthma surveillance effort is to provide community specific asthma data to enhance primary and secondary prevention efforts.

Comparison with Year One and Year Two Data

The statewide prevalence of pediatric asthma found in this survey of school nurses was 10.0%, however, the prevalence by individual school was as high as 48%. This compares to year one (from a smaller number of schools) and year two results which showed an overall prevalence of 9.2% and 9.5%, respectively, with a range as high as 39.1% in participating schools for year two [5-6]. Although statewide prevalence has been observed to increase with each year of surveillance, it is more likely due to an increased understanding of the surveillance program and instructions by school nurses, as well as increased participation of schools. When any surveillance program is initiated, data generally tends to improve over time as the reporting entity's understanding of requested information also improves. As the surveillance program continues, there is an ongoing communication with schools reporting and hence more standardized reporting procedures.

Comparison with Other Surveillance Programs

The statewide asthma prevalence observed in year three differs from other state and national childhood asthma surveillance efforts. The 2003 BRFSS reports that 9.2% of Massachusetts children under 18 years old currently have asthma. The BRFSS prevalence of current asthma for children aged 5-9 and 10-14, the age groups comparable to our K-8 grade range, are 11.1% and 11.9%, respectively [17]. The 2004 CDC National Health Interview Survey (NHIS) reports that 7.9% of U.S. children 0-14 years old currently have asthma [18]. The 2003 National Survey of Children's Health reports that 8.8% of U.S children, and 10.2% of Massachusetts children currently have asthma [3].

BRFSS and NHIS asthma prevalence figures give an idea of the range in which to expect Massachusetts prevalence values to fall within, but different methodologies and target populations make them less than ideal for comparison with MDPH surveillance figures. The BRFSS and NHIS figures are derived from samples of households and self-

reported health information that may affect the precision of the prevalence estimates. A school-based surveillance effort similar to that used in Massachusetts and, therefore, producing more comparable figures is presented in a recent report describing nurse-reported asthma in Connecticut students. The report describes a 9.7% asthma prevalence among Connecticut students in grades K-5 [19]. Reported asthma prevalence in Massachusetts K-5 students described in this report was 7.9%. Prevalence data for grade 6-8 students in Connecticut are not available for comparison.

The Value of Asthma Surveillance

The value of the Massachusetts approach to asthma surveillance is several-fold. As part of a separate investigation of asthma in the Merrimack Valley, the MDPH found school nurses and student health records to be a valuable and reliable source of health information. Further, tracking the prevalence of asthma through the schools will make it possible for the first time to assess the magnitude of the problem of pediatric asthma at the local level and, notably, to better determine the potential role of indoor and outdoor environmental exposures in the etiology of the disease. As stated previously, community-level asthma prevalence data will be useful in planning and implementing environmental health investigations and public health interventions based on factors specific to the community in question.

V. Future Efforts Aimed at Pediatric Asthma Surveillance

This report summarizes the third year of a four year effort that the MDPH is planning to carry out as part of its Environmental Public Health Tracking Project. During the project's first year, asthma surveillance was carried out in a subset of Massachusetts schools. In year two the MDPH expanded its pediatric asthma tracking effort to include all public, private, and charter schools serving any of grades K-8 in each of the Commonwealth's 372 school districts. Year four data, currently being collected, also targets all Commonwealth schools serving any of grades K-8. In addition to estimating

prevalence by individual school, data will be collected to determine the community of residence of all students, with and without asthma. This will enable estimates of asthma prevalence to be calculated, for the first time, for every Massachusetts city and town.

Once four years of data have been collected, and the validity of school nurse reports has been investigated as discussed previously, analyses of the changes in reported school asthma prevalence over the four year data collection period will be performed.

This report highlights important progress that has been made toward the establishment of a comprehensive, statewide pediatric asthma surveillance system in the Commonwealth of Massachusetts.

VI. References

1. U.S. Centers for Disease Control and Prevention (CDC), *Measuring childhood asthma prevalence before and after the 1997 redesign of the National Health Interview Survey--United States*. MMWR Morb Mortal Wkly Rep, 2000. **49**(40): p. 908-11.
2. Bloom, B., et al., *Summary Health Statistics for U.S. Children: National Health Interview Survey, 2001*. 10(216), in *Vital Health Stat*. 2003, National Center for Health Statistics.: Washington, DC.
3. American Lung Association, Epidemiology and Statistics Unit. *Trends in Asthma Morbidity and Mortality*. May 2005.
4. Mannino, D.M., et al., *Surveillance for asthma--United States, 1960-1995*. MMWR CDC Surveill Summ, 1998. **47**(1): p. 1-27.
5. Massachusetts Department of Public Health, C.E.H., *Pediatric Asthma in Massachusetts 2002-2003*. 2004.
6. Massachusetts Department of Public Health, C.E.H., *Pediatric Asthma in Massachusetts 2003-2004*. 2005.
7. Boezen, H.M., et al., *Effects of ambient air pollution on upper and lower respiratory symptoms and peak expiratory flow in children*. Lancet, 1999. **353**(9156): p. 874-8.
8. Delfino, R.J., et al., *Association of asthma symptoms with peak particulate air pollution and effect modification by anti-inflammatory medication use*. Environ Health Perspect, 2002. **110**(10): p. A607-17.
9. Tolbert, P.E., et al., *Air quality and pediatric emergency room visits for asthma in Atlanta, Georgia, USA*. Am J Epidemiol, 2000. **151**(8): p. 798-810.
10. Sturm, J.J., K. Yeatts, and D. Loomis, *Effects of tobacco smoke exposure on asthma prevalence and medical care use in North Carolina middle school children*. Am J Public Health, 2004. **94**(2): p. 308-13.
11. Rosenstreich, D.L., et al., *The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma*. N Engl J Med, 1997. **336**(19): p. 1356-63.
12. Smith, B.J., et al., *Health effects of daily indoor nitrogen dioxide exposure in people with asthma*. Eur Respir J, 2000. **16**(5): p. 879-85.

13. Lee, Y.L., et al., *Indoor and outdoor environmental exposures, parental atopy, and physician-diagnosed asthma in Taiwanese schoolchildren*. Pediatrics, 2003. **112**(5): p. e389.
14. El-Sharif, N., et al., *Familial and environmental determinants for wheezing and asthma in a case-control study of school children in Palestine*. Clin Exp Allergy, 2003. **33**(2): p. 176-86.
15. Aligne, C.A., et al., *Risk factors for pediatric asthma. Contributions of poverty, race, and urban residence*. Am J Respir Crit Care Med, 2000. **162**(3 Pt 1): p. 873-7.
16. Heinrich, J., et al., *Trends in prevalence of atopic diseases and allergic sensitization in children in Eastern Germany*. Eur Respir J, 2002. **19**(6): p. 1040-6.
17. Massachusetts Department of Public Health, C.f.H.I., Statistics, Research, and Evaluation, *a Profile of Health among Massachusetts Adults, 2003*. 2004.
18. U.S. Centers for Disease Control and Prevention, *Early Release of Selected Estimates Based on Data From the January-September 2004 National Health Interview Survey*. 2005.
19. Storey, E., et al., *A Survey of Asthma Prevalence in Elementary School Children*. 2003, Environment and Human Health, Inc.: North Haven, CT.